PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

Final Report
Investigation Results For
Elmer Andersen Human Services Building

Date: 5/31/2012

Admin Minnesota
DEPARTMENT OF ADMINISTRATION

Minnesota Department of Human Services

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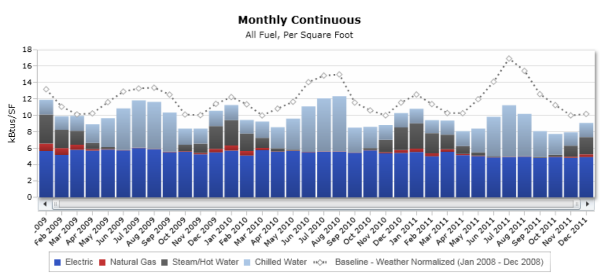
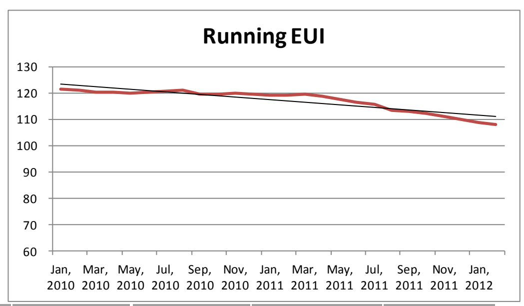
Elmer Andersen Human Services Building Energy Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of Elmer Andersen Human Services Building was performed by Sebesta Blomberg, Inc. This report is the result of that information.

Payback Information and Energy Savings				
Total project costs (Without Co-funding)			**Project costs with Co-funding**	
Total costs to date including study	$76,401		Total Project Cost	$151,891
Future costs including Implementation , Measurement & Verification	$75,940		Study and Administrative Cost Paid with ARRA Funds	($79,401)
Total Project Cost	$151,891		Utility Co-funding	$
			Total costs after co-funding	$71,940
Estimated Annual Total Savings ($)	$25,017		Estimated Annual Total Savings ($)	$25,017
Total Project Payback	6.1		Total Project Payback with co-funding	3.0
Electric Energy Savings	**10.4%**	**and**	**District Energy Savings**	**2.7 %**





Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	365	414,068	50,603,193	57,862,039	-7,258,847	-13%	$1,062,717.83	$0.02
2010	365	414,068	49,548,310	59,447,862	-9,899,552	-17%	$1,045,867.90	$0.02
2011	365	414,068	45,544,888	60,788,538	-15,243,649	-25%	$1,047,548.72	$0.02

Elmer Andersen Human Services Building Consumption Report
Total energy use decreased 11% during the period of the investigation

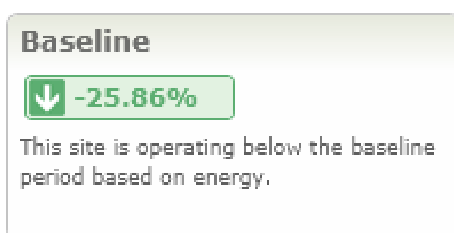
STATE OF MINNESOTA B3 BENCHMARKING

Summary Tables

Elmer Andersen Human Services Building	
Location	540 Cedar Street, St Paul, MN 55155
Facility Manager	Gene Peterman
Interior Square Footage	414,068
PBEEEP Provider	Sebesta Blomberg, Inc.
State's Project Manager	Harvey Jaeger
Annual Energy Cost	$ 1,047,549 (2011) Source: B3
Utility Company	Xcel Energy (Electric) St Paul District Energy (Steam & Chilled Water)
Site Energy Use Index (EUI)	120 kBtu/ft^2 (at start of study) 107 kBtu/ft^2 (at end of study)
Benchmark EUI (from B3)	113 kBtu/ft^2

Building Name	State ID	Square Footage	Year Built
Elmer Andersen Human	G02310273	414,068	2005

	Mechanical Equipment Summary Table
Quantity	**Equipment Description**
1	Honeywell EBI Automation System
10	Air Handlers
112	VAV Boxes
294	Fan-Powered VAV Boxes
13	Fan Coil Units
12	Computer Room Air Conditioning (CRAC) Units
25	Cabinet Unit Heaters and Unit Heaters
2	Steam Boilers
1	Back-up Generator



Implementation Information			
Estimated Annual Total Savings ($)			$25,017
Total Estimated Implementation Cost ($)			$71,940
GHG Avoided in U.S Tons (CO2e)			233
Electric Energy Savings (kWh) 10.4 % Savings 2011 Electric Usage 2,214,850 kWh (from B3)			230,054
Electric Demand Savings (Peak kW)			0
District Hot Water Savings (MMBtu) 1.8 % Savings 2011 Usage 5,199 MMBtu from B3			92
District Chilled Water Savings (MMBtu) 3.1 % Savings 2011 Usage 14,555 MMBtu from B3			450
Statistics			
Number of Measures identified			7
Number of Measures with payback < 3 years			2
Screening Start Date	5/4/2010	Screening End Date	6/9/2010
Investigation Start Date	10/15/2010	Investigation End Date	4/30/2012
Final Report	5/31//2012		

Elmer Andersen Human Services Building Cost Information		
Phase	**To date**	**Estimated**
Screening	$3,753	
Investigation [Provider]	$65,800	
Investigation [CEE]	$6,848	$1,000
Implementation		$71,940
Implementation [CEE]		$1,000
Measurement & Verification	0	$1,000
Total	$76,401	$74,940

Co-funding Summary	
Study and Administrative Cost	$79,401
Utility Co-Funding - Estimated Total ($)	$
Total Co-funding ($)	$79,401

Facility Overview

The energy investigation identified 4.7% of total energy savings at Elmer Andersen Human Services Building with measures that payback in less than 15 years and do not adversely affect occupant comfort. The energy savings opportunities identified at Elmer Andersen Human Services Building are based on adjusting the schedule of equipment to match actual building occupancy hours, adjusting control points for fan powered VAV boxes, correcting economizer operation and adjusting the underfloor air distribution system to maintain the duct static set point. The total cost of implementing all the measures is $71,940.

Implementing all these measures can save the facility approximately $25,017 a year with a combined payback period of 2.9 years before rebates based on the implementation cost only (excluding study and administrative costs). These measures will produce 10.4 % electrical savings and 1.8 % hot water savings and 3.1 % chilled water savings. The building is currently performing at 5% below the Minnesota Benchmarking and Beyond database (B3) benchmark; energy usage during the period of the study declined by 11%.

The primary energy intensive systems at Elmer Andersen Human Services Building are described here:

The Andersen Office Building is one large detached building consisting of 395,752 interior square feet. The building has nine stories above ground and one below. The conditioned spaces are primarily offices and there is a data center on the basement level. Levels 5 and 6 and Levels 7 and 8 have open staircases between them while the rest of the floors are closed off to one another. The building has an attached seven story unconditioned parking ramp. The building was constructed in 2005 and was commissioned at the time of construction.

Controls and Automation System

The building runs on a Honeywell EBI R310.1 automation system, which is part of the State Capitol Complex system. All equipment is DDC and all equipment is on the automation system except several Cabinet Unit Heaters, Unit Heaters, and pumps. There are a total of approximately 300 points on the automation system.

Primary Energy Sources

The building uses chilled and hot water from District Energy St. Paul. Some of the District chilled water is routed directly to the air handling units (AHUs) and some is run through heat exchangers that send chilled water to Computer Room Air Conditioning (CRAC) units in the data center. The District hot water is run through heat exchangers and the hot water is sent to the air handlers and terminal equipment. There are two natural gas steam boilers that are used solely for humidification in the air handlers.

Mechanical Equipment

There are a total of ten AHUs serving the Andersen Office Building. Nine of the AHUs are located in the Penthouse (Level 9) and are variable air volume units with VAV boxes and/or Fan-Powered VAV (FPVAV) boxes. There is one constant volume air handler located on the first floor (Level 1) that serves the loading dock area. Levels 0 (the below ground level) and 1 have VAV boxes in the ceiling plenums. Levels 2-8 have underfloor supply plenums with perimeter FPVAVs. There are round floor diffusers that can be adjusted to supply varying amounts of air to the spaces directly from the underfloor supply plenum. There are also FPVAVs on these floors that are ducted to diffusers along the exterior walls. The FPVAVs take air from the underfloor supply plenum and heat it as needed based on thermostats along the exterior walls. The occupants have no control over the space temperature except for adjusting the amount of air coming out of the round floor diffusers. Level 9 is the Penthouse and is heated by eleven fan coil units.

Metering

There is one natural gas meter, three electric meters (one dedicated to the data center), two District Energy (St. Paul) meters (one for chilled water and one for hot water), and one fuel oil meter. Fuel oil is used only by the back-up generator.

Findings Summary

Site: Elmer Anderson

Eco #	Building	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
5	Elmer Anderson Office Building	AHU-3 Operates 24/7	$3,630	$6,377	0.57	$0	0.57	66
7	Elmer Anderson Office Building	Fan Powered VAV minimum CFM setpoints are the same as the maximums.	$11,660	$7,138	1.63	$0	1.63	104
8	Elmer Anderson Office Building	Building Chilled water pump operating during outside air conditions below 55F.	$1,540	$492	3.13	$0	3.13	7
9	Elmer Anderson Office Building	Space heating is excessive.	$3,080	$954	3.23	$0	3.23	3
2	Elmer Anderson Office Building	AHU Economizers not functioning as designed.	$27,500	$7,249	3.79	$0	3.79	22
4	Elmer Anderson Office Building	Toilet exhaust fan operates beyond normal hours of occupancy.	$880	$135	6.53	$0	6.53	2
1	Elmer Anderson Office Building	AHU Supply Fan not maintaining duct static pressure setpoint.	$23,650	$2,673	8.85	$0	8.85	29
		Total for Findings with Payback 3 years or less:	**$15,290**	**$13,515**	**1.13**	**$0**	**1.13**	**169**
		Total for all Findings:	**$71,940**	**$25,017**	**2.88**	**$0**	**2.88**	**233**

PBEEEP was made possible with funding from the U.S. Department of Energy
and the MN Department of Commerce.

Elmer Andersen Building

Finding Type Number	Finding Type	Relevant Findings (if any)	Looked for, Not found	Not relevant
a.1 (1)	Time of Day enabling is excessive	1		
a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	1		
a.3 (3)	Lighting is on more hours than necessary.		1	
a.4 (4)	OTHER_Equipment Scheduling/Enabling	1		
b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position,	2		
b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set	2		
b.3 (7)	OTHER_Economizer/OA Loads		1	
c.1 (8)	Simultaneous Heating and Cooling is present and excessive	3		
c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	1		
c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints		1	
c.4 (11)	OTHER_Controls	1		
d.1 (12)	Daylighting controls or occupancy sensors need optimization.		1	
d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	9		
d.3 (14)	Fan Speed Doesn't Vary Sufficiently	1		
d.4 (15)	Pump Speed Doesn't Vary Sufficiently		1	
d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	7		
d.6 (17)	Other_Controls (Setpoint Changes)	2		
e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal		1	
e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal		1	

e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal		1	
e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal	1		
e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal		1	
e.6 (22)	Other_Controls (Reset Schedules)		1	on looked for, but did
f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit		1	on looked for, but did
f.2 (24)	Pump Discharge Throttled			1
f.3 (25)	Over-Pumping	8		
f.4 (26)	Equipment is oversized for load.		1	
f.5 (27)	OTHER_Equipment Efficiency/Load Reduction		1	
g.1 (28)	VFD Retrofit - Fans			1
g.2 (29)	VFD Retrofit - Pumps			1
g.3 (30)	VFD Retrofit - Motors (process)			1
g.4 (31)	OTHER_VFD			1
h.1 (32)	Retrofit - Motors			1
h.2 (33)	Retrofit - Chillers			1
h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			1
h.4 (35)	Retrofit - Boilers			1
h.5 (36)	Retrofit - Packaged Gas fired heating			1
h.6 (37)	Retrofit - Heat Pumps			1
h.7 (38)	Retrofit - Equipment (custom)			1
h.8 (39)	Retrofit - Pumping distribution method		1	
h.9 (40)	Retrofit - Energy/Heat Recovery			1
h.10 (41)	Retrofit - System (custom)			1
h.11 (42)	Retrofit - Efficient Lighting		1	

h.12 (43)	Retrofit - Building Envelope			1
h.13 (44)	Retrofit - Alternative Energy			1
h.14 (45)	OTHER_Retrofit			
i.1 (46)	Differed Maintenance from Recommended/Standard		1	
i.2 (47)	Impurity/Contamination		1	
i.3 ( )	Leaky/Stuck Damper		1	
i.4 ( )	Leaky/Stuck Valve		1	
i.5 (48)	OTHER_Maintenance		1	
j.1 (49)	OTHER			

Findings Glossary: Findings Examples

a.1 (1)	**Time of Day enabling is excessive**	
		• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
a.2 (2)	**Equipment is enabled regardless of need, or such enabling is excessive**	
		• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
a.3 (3)	**Lighting is on more hours than necessary**	
		• Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
a.4 (4)	**OTHER Equipment Scheduling and Enabling**	
		• Please contact PBEEEP Project Engineer for approval
b.1 (5)	**Economizer Operation – Inadequate Free Cooling**	
		• Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer) • Economizer linkage is broken • Economizer setpoints could be optimized • Plywood used as the outdoor air control • Damper failed in minimum or closed position
b.2 (6)	**Over-Ventilation**	
		• Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
b.3 (7)	**OTHER Economizer/Outside Air Loads**	
		• Please contact PBEEEP Project Engineer for approval
c.1 (8)	**Simultaneous Heating and Cooling is present and excessive**	
		• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
c.2 (9)	**Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement**	
		• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
c.3 (10)	**Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints**	
		• CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
c.4 (11)	**OTHER Controls**	
		• Please contact PBEEEP Project Engineer for approval
d.1 (12)	**Daylighting controls or occupancy sensors need optimization**	
		• Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
d.2 (13)	**Zone setpoint setup / setback are not implemented or are sub-optimal**	
		• The cooling setpoint is 74 ºF 24 hours per day
d.3 (14)	**Fan Speed Doesn't Vary Sufficiently**	
		• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating

d.4 (15)	**Pump Speed Doesn't Vary Sufficiently**	
		• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
d.5 (16)	**VAV Box Minimum Flow Setpoint is higher than necessary**	
		• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
d.6 (17)	**Other Controls (Setpoint Changes)**	
		• Please contact PBEEEP Project Engineer for approval
e.1 (18)	**HW Supply Temperature Reset is not implemented or is sub-optimal**	
		• HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
e.2 (19)	**CHW Supply Temperature Reset is not implemented or is sub-optimal**	
		• CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature.
e.3 (20)	**Supply Air Temperature Reset is not implemented or is sub-optimal**	
		• The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
e.4 ( )	**Supply Duct Static Pressure Reset is not implemented or is suboptimal**	
		• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
e.5 (21)	**Condenser Water Temperature Reset is not implemented or is sub-optimal**	
		• CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
e.6 (22)	**Other Controls (Reset Schedules)**	
		• Please contact PBEEEP Project Engineer for approval
f.1 (23)	**Lighting system needs optimization - Spaces are overlit**	
		• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
f.2 (24)	**Pump Discharge Throttled**	
		• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
f.3 (25)	**Over-Pumping**	
		• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
f.4 (26)	**Equipment is oversized for load**	
		• The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity

f.5 (27)	**OTHER Equipment Efficiency/Load Reduction**	
		• Please contact PBEEEP Project Engineer for approval
g.1 (28)	**VFD Retrofit Fans**	
		• Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
g.2 (29)	**VFD Retrofit - Pumps**	
		• 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
g.3 (30)	**VFD Retrofit - Motors (process)**	
		• Motor is constant speed and uses a variable pitch sheave to obtain speed control.
g.4 (31)	**OTHER VFD**	
		• Please contact PBEEEP Project Engineer for approval
h.1 (32)	**Retrofit - Motors**	
		• Efficiency of installed motor is much lower than efficiency of currently available motors
h.2 (33)	**Retrofit - Chillers**	
		• Efficiency of installed chiller is much lower than efficiency of currently available chillers
h.3 (34)	**Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)**	
		• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
h.4 (35)	**Retrofit - Boilers**	
		• Efficiency of installed boiler is much lower than efficiency of currently available boilers
h.5 (36)	**Retrofit - Packaged Gas-fired heating**	
		• Efficiency of installed heaters is much lower than efficiency of currently available heaters
h.6 (37)	**Retrofit - Heat Pumps**	
		• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
h.7 (38)	**Retrofit - Equipment (custom)**	
		• Efficiency of installed equipment is much lower than efficiency of currently available equipment
h.8 (39)	**Retrofit - Pumping distribution method**	
		• Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
h.9 (40)	**Retrofit - Energy / Heat Recovery**	
		• Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
h.10 (41)	**Retrofit - System (custom)**	
		• Efficiency of installed system is much lower than efficiency of another type of system
h.11 (42)	**Retrofit - Efficient lighting**	
		• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.

h.12 (43)	**Retrofit - Building Envelope**	
		• Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
h.13 (44)	**Retrofit - Alternative Energy**	
		• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
h.14 (45)	**OTHER Retrofit**	
		• Please contact PBEEEP Project Engineer for approval
i.1 (46)	**Differed Maintenance from Recommended/Standard**	
		• Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
i.2 (47)	**Impurity/Contamination**	
		• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
i.3 ( )	**Leaky/Stuck Damper**	
		• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.4 ( )	**Leaky/Stuck Valve**	
		• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.5 (48)	**OTHER Maintenance**	
		• Please contact PBEEEP Project Engineer for approval
j.1 (49)	**OTHER**	
		• Please contact PBEEEP Project Engineer for approval

Findings Summary

Building: Elmer Anderson Office Building
Site: Elmer Anderson

PBEEEP State Government

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
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cee Center for Energy and Environment

Admin Minnesota DEPARTMENT OF ADMINISTRATION

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Elmer Anderson Office Building

FWB Number:	11801	Eco Number:	1
Site:	Elmer Anderson	Date/Time Created:	5/30/2012

Investigation Finding:	AHU Supply Fan not maintaining duct static pressure setpoint.	Date Identified:	12/20/2010
Description of Finding:	The supply fan VFD remains at or near 100% speed and cannot achieve the supply duct static pressure setpoint. Fan is at 99% speed, duct static 0.1", duct static SP 1.3". This applies to AHU-1, AHU-2, AHU-5, AHU-6, AHU-7, AHU-8, and AHU-9.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Fan Speed Doesn't Vary Sufficiently		

Implementer:	Controls Contractor	Benefits:	Electric savings, Heating savings, Chilled water savings and improved occupant comfort.
Baseline Documentation Method:	Trending of AHU supply fan speeds, visual inspection and Functional Testing of AHU-2 to determine how it and the similar AHU's react to floor plenum pressure changes.		
Measure:	Change supply fan control from duct pressure based to supply plenum.		
Recommendation for Implementation:	❑ Investigate the existing sensor/wiring configuration of the duct pressure and plenum pressure sensors. ❑ If the plenum pressure sensor is not wired such that it is communicating with the building automation system, rewire the plenum pressure sensor to communicate with the automation system. (It may be possible to do this by disconnecting the wires used for the duct pressure sensor and connecting them to the plenum pressure sensor.) ❑ Verify floor plenum pressure sensor is the correct sensor for measuring low differential pressures. (The Honeywell sensor shown in the original installation bill of materials is Part Number: PR-274-R2-mA and reads a Pressure Differential of 0.0-0.25 "wc) ❑ Install tubing such that the plenum pressure sensor measures the differential of the floor plenum vs. the occupied space. (If unobstructed the existing tubing for the space may be disconnected from the duct pressure sensor and reconnected to the plenum pressure sensor.) ❑ Once operational check the condition and calibration of the existing floor plenum sensor. ❑ If the sensor is out of calibration, then recalibrate. If faulty, replace the sensor. ❑ Reprogram the building automation system to control supply fan speed based on the supply plenum pressure instead of duct pressure. The initial plenum pressure setpoint to be set at the original floor plenum design of 0.04"-0.06 "wc (adj.). This point shall be made adjustable. It is expected that during the heating season when occupants have closed their floor diffusers the plenum pressure can be set lower since all heating is provided by fan powered VAVs. ❑ Test and verify proper operation of the supply fans by adjusting the floor plenum pressure setpoint and by manipulating the floor diffusers. ❑ Provide training to the occupants so that they learn to adjust their own floor diffusers to obtain the desired space temperature. In the cooling season it is expected that all diffusers will be open to varying positions with an overall average of 50%. During the heating season the diffusers are expected to be mostly closed and the perimeter VAVs will be providing most of the space conditioning.		
Evidence of Implementation Method:	Trending of AHU supply fan motors speeds, floor plenum pressures, and setpoints at an interval of 15 minutes or less and for a duration of at least 3 weeks. Functionally test the new control strategy and verify fan modulation based on floor plenum pressure.		

Annual Electric Savings (kWh): Estimated Annual kWh Savings ($):	30,331 $1,787	Annual District Energy-Chilled Water Savings (kBtu): Est Annual District Energy-Chilled Water Savings ($):	10,990 $231
Annual District Energy-Hot Water Savings (Gallons): Est Annual District Energy-Hot Water Savings ($):	29,782 $655	Contractor Cost ($): PBEEEP Provider Cost for Implementation Assistance ($): Total Estimated Implementation Cost ($):	$17,413 $6,237 $23,650

Estimated Annual Total Savings ($):	$2,673	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	8.85	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	8.85	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	29	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	10.7%	Percent of Implementation Costs:	32.9%

Findings Details

Building: Elmer Anderson Office Building

FWB Number:	11801	Eco Number:	2
Site:	Elmer Anderson	Date/Time Created:	5/30/2012

Investigation Finding:	AHU Economizers not functioning as designed.	Date Identified:	12/20/2010
Description of Finding:	Trending indicates the return enthalpy is overridden in an effort to manually control the economizer function. During all seasons of trending the RA and OA enthalpy sensor readings are not changing as outside conditions change. The RA and OA enthalpy points are overridden to constant values and do not allow the economizer to function optimally. OA dampers are not operating based on RA/OA enthalpy as designed. This applies to AHU-1, AHU-2, AHU-3, AHU-5, AHU-6, AHU-7, AHU-8, and AHU-9.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Economizer Operation - Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)		

Implementer:	Controls Contractor	Benefits:	District hot water and chilled water savings due to increased Economizer efficiency.
Baseline Documentation Method:	Trending of OA enthalpy, RA enthalpy, and OA damper position.		
Measure:	Release enthalpy overrides allowing economizer to operate as designed. Control economizers to AHU discharger air temperature.		
Recommendation for Implementation:	1. Release enthalpy overrides. 2. Change economizer outside air temperature limit from 65F to 70F. 3. Control economizer to DAT setpoint. 4. Calibrate OA and RA temperature and humidity sensors.		
Evidence of Implementation Method:	Trending of outside, return, and exhaust dampers, RAT, MAT, DAT, and OAT, RA Enthalpy, and OA Enthalpy, supply/return fan speeds, at an interval of 15 minutes or less and for a duration of at least 3 weeks.		

Annual District Energy-Chilled Water Savings (kBtu):	345,187	Contractor Cost ($):	$22,154
Est Annual District Energy-Chilled Water Savings ($):	$7,249	PBEEEP Provider Cost for Implementation Assistance ($):	$5,346
		Total Estimated Implementation Cost ($):	$27,500

Estimated Annual Total Savings ($):	$7,249	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	3.79	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	3.79	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	22	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	29.0%	Percent of Implementation Costs:	38.2%

Findings Details

Building: Elmer Anderson Office Building

FWB Number:	11801	Eco Number:	4
Site:	Elmer Anderson	Date/Time Created:	5/30/2012

Investigation Finding:	Toilet exhaust fan operates beyond normal hours of occupancy.	Date Identified:	2/1/2012
Description of Finding:	Trending shows the toilet exhaust is active from 5:00-23:00. The toilet exhaust schedule should match the building occupancy schedule.		
Equipment or System(s):	Other	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	In-House Staff	Benefits:	Reduced electric usage by fan.
Baseline Documentation Method:	Trending of EF3 and EF4 speed.		
Measure:	Change EF schedule to 6:00-18:00.		
Recommendation for Implementation:	Change operating schedule for EF-3 and EF-4 to 6:00-18:00 M-F		
Evidence of Implementation Method:	Trending of EF3 and EF4 status/speed at an interval of 15 minutes or less and record for a minimum of 2 weeks. Ensure that the exhaust fans are operating according to the revised schedule.		

Annual Electric Savings (kWh):	2,287	Contractor Cost ($):	$583
Estimated Annual kWh Savings ($):	$135	PBEEEP Provider Cost for Implementation Assistance ($):	$297
		Total Estimated Implementation Cost ($):	$880

Estimated Annual Total Savings ($):	$135	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	6.53	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	6.53	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.5%	Percent of Implementation Costs:	1.2%

Findings Details

Building: Elmer Anderson Office Building

FWB Number:	11801	Eco Number:	5
Site:	Elmer Anderson	Date/Time Created:	5/30/2012

Investigation Finding:	AHU-3 Operates 24/7	Date Identified:	2/1/2012
Description of Finding:	Trending shows AHU-3 operates 24/7 during all seasons. This is likely to provide conditioning to electrical rooms and data closets. All VAVs which are not critical spaces should go to a minimum flow of 0 CFM during unoccupied times.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Controls Contractor	Benefits:	Reduced electric, district hot/chilled water usage.
Baseline Documentation Method:	Trending of AHU-3 fan operation.		
Measure:	Implement an unoccupied mode for AHU-3.		
Recommendation for Implementation:	Program occupancy schedule for all VAVs supplied by AHU-3. Critical spaces to remain occupied 24/7. Verify with owner which VAVs can be reduced to a minimum flow of 0 cfm during unoccupied hours and have them scheduled according to building occupancy. When this unoccupied mode is active the AHU minimum outside air CFM shall be set to 0.		
Evidence of Implementation Method:	Trending of AHU-3 SF status, OA damper position, and VAV occupancies. Trending interval to be 15 minutes or less and record for a minimum of 3 weeks. Verify that the OA damper goes to minimum position when economizing is not appropriate and VAV boxes serving noncritical spaces go to 0 cfm during unoccupied mode .		

Annual Electric Savings (kWh): Estimated Annual kWh Savings ($):	67,889 $3,999	Annual District Energy-Chilled Water Savings (kBtu): Est Annual District Energy-Chilled Water Savings ($):	93,721 $1,968
Annual District Energy-Hot Water Savings (Gallons): Est Annual District Energy-Hot Water Savings ($):	18,625 $410	Contractor Cost ($): PBEEEP Provider Cost for Implementation Assistance ($): Total Estimated Implementation Cost ($):	$3,036 $594 $3,630

Estimated Annual Total Savings ($): Initial Simple Payback (years): Simple Payback w/ Utility Co-Funding (years): GHG Avoided in U.S. Tons (C02e):	$6,377 0.57 0.57 66	Utility Co-Funding for kWh ($): Utility Co-Funding for kW ($): Utility Co-Funding for therms ($): Utility Co-Funding - Estimated Total ($):	$0 $0 $0 $0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	25.5%	Percent of Implementation Costs:	5.0%

Findings Details

Building: Elmer Anderson Office Building

FWB Number:	11801	Eco Number:	7
Site:	Elmer Anderson	Date/Time Created:	5/30/2012

Investigation Finding:	Fan Powered VAV minimum CFM setpoints are the same as the maximums.	Date Identified:	2/1/2012
Description of Finding:	Fan powered VAV minimum airflow settings are the same as the maximum airflow settings. This does not allow the VAV fans to modulate up and down based on the space temperature conditions and end up overheating spaces. The minimum airflow setpoints could be changed to 60% of the maximum airflow and the fans could then modulate as needed. This applies to the VAVs served by AHU-1, 2, 5, 6, 7, 8, and 9.		
Equipment or System(s):	VAV terminal unit	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Fan Speed Doesn't Vary Sufficiently		

Implementer:	Controls Contractor	Benefits:	Reduced air demand on the AHUs which will result in slower supply fan speeds and reduce electrical consumption.
Baseline Documentation Method:	Trending of AHU return air temperatures and space temperature data loggers during the heating season. Mechanical design drawings contain FPVAV schedules with MIN/MAX airflows as the same value.		
Measure:	Change minimum VAV airflow setting to 60% of maximum airflow setpoint.		
Recommendation for Implementation:	For fan powered VAVs, where the minimum airflow setpoint is the same as the maximum airflow setpoint, change the minimum setpoint to 60% (adj.) of the maximum. The fan modulation as described in the existing Honeywell as-built control sequence will remain. Commission VAVs to ensure fan speed modulates based on space demand.		
Evidence of Implementation Method:	Trending of OAT, space temps, and AHU fan speeds. Trending interval to be 15 minutes or less and have a minimum duration of 3 weeks during the heating season.		

Annual Electric Savings (kWh):	121,188	Contractor Cost ($):	$9,284
Estimated Annual kWh Savings ($):	$7,138	PBEEEP Provider Cost for Implementation Assistance ($):	$2,376
		Total Estimated Implementation Cost ($):	$11,660

Estimated Annual Total Savings ($):	$7,138	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.63	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.63	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	104	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	28.5%	Percent of Implementation Costs:	16.2%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Elmer Anderson Office Building

FWB Number:	11801	Eco Number:	8
Site:	Elmer Anderson	Date/Time Created:	5/30/2012

Investigation Finding:	Building Chilled water pump operating during outside air conditions below 55F.	Date Identified:	2/1/2012
Description of Finding:	Trending shows the building chilled water pumps which serve the AHUs are active down to 30F. At these outdoor conditions no cooling should be required. Trending also shows all AHU, except AHU-10, cooling valves to be closed during these OA conditions. AHU-10 conditions the loading dock and should not require cooling during these times. The Chilled water pump VFD operates between 39-44% speed to supply water to one AHU. The chilled water pumps should not be activated below 55F.		
Equipment or System(s):	Pump, primary CHW (evap-only)	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Equipment is enabled regardless of need, or such enabling is excessive		

Implementer:	Controls Contractor	Benefits:	Reduced pump run-hours and electricity usage.
Baseline Documentation Method:	Trending of building CHW pump speeds and AHU cooling valve positions.		
Measure:	Change Building Chilled water pump sequence so the pumps are off when OAT is below 55F.		
Recommendation for Implementation:	Program chilled water pumps to activate only when outside air temperatures are above 55F.		
Evidence of Implementation Method:	Trending of OAT, chilled water pumps 1 and 2, and AHU cooling valves. Trending to occur during a shoulder season when outdoor air conditions go above and below 55F often. Set trending interval to be 15 minutes or less and record for a minimum of 2 weeks.		

Annual Electric Savings (kWh):	8,359	Contractor Cost ($):	$1,243
Estimated Annual kWh Savings ($):	$492	PBEEEP Provider Cost for Implementation Assistance ($):	$297
		Total Estimated Implementation Cost ($):	$1,540

Estimated Annual Total Savings ($):	$492	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	3.13	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	3.13	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	7	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	2.0%	Percent of Implementation Costs:	2.1%

Findings Details

Building: Elmer Anderson Office Building

FWB Number:	11801	Eco Number:	9
Site:	Elmer Anderson	Date/Time Created:	5/30/2012

Investigation Finding:	Space heating is excessive.	Date Identified:	2/1/2012
Description of Finding:	RAT trends and data logger records show space temps during the heating season range from 73-76F. To be compliant with the State of MN requirement these space must be maintained at 68-70F. It is recommended that the space setpoints be changed to 70F in heating.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Other_Controls (Setpoint Changes)		

Implementer:	In-House Staff	Benefits:	Reduced HW consumption.
Baseline Documentation Method:	Trending of all AHU return air temperatures and space temperature data loggers during the heating season.		
Measure:	Change space temperature setpoints for the AHUs and fan powered VAVs to 70F during the heating season.		
Recommendation for Implementation:	Change space temperature setpoint to 70F (adj.) in heating mode only. This applies to all occupied spaces.		
Evidence of Implementation Method:	Trending of space temperatures and AHU return air temperatures. Set trending interval to be 15 minutes or less and record for a minimum of 2 weeks during the heating season. Verify the 70F space setpoint is maintained.		

Annual District Energy-Hot Water Savings (Gallons):	43,376	Contractor Cost ($):	$2,486
Est Annual District Energy-Hot Water Savings ($):	$954	PBEEEP Provider Cost for Implementation Assistance ($):	$594
		Total Estimated Implementation Cost ($):	$3,080

Estimated Annual Total Savings ($):	$954	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	3.23	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	3.23	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	3	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.8%	Percent of Implementation Costs:	4.3%

Deleted Findings Summary

Building: Elmer Anderson Office Building

Site: Elmer Anderson

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
3	AHU-4 Simultaneous heating and cooling: not found in QA	$0	$0	0.00	$0	0.00	0
6	Heating valves operating during unoccupied hours: payback > 15 yrs	$0	$0	0.00	$0	0.00	0
	Total for Findings with Payback 3 years or less:	**$0**	**$0**	**0.00**	**$0**	**0.00**	**0**
	Total for all Findings:	**$0**	**$0**	**0.00**	**$0**	**0.00**	**0**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Deleted Findings Details

Building: Elmer Anderson Office Building

FWB Number:	11801	Eco Number:	3
Site:	Elmer Anderson	Date/Time Created:	5/30/2012

Investigation Finding:	AHU-4 Simultaneous heating and cooling: not found in QA	Date Identified:	2/1/2012
Description of Finding:	Trending shows both the heating and cooling valves open during outside air conditions of 45F-60F. CEE reviewed the trend data for AHU-4 and found that although both the heating and cooling valves were open simultaneously, one was always open less than 5%. Eliminating the times when both valves are open such a small amount will lead to little or no energy savings and this measure has been deleted by PBEEEP.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Deleted
Finding Type:	Finding Deleted by PBEEEP		

Implementer:	Controls Contractor	Benefits:	Reduced district hot water and chilled water use.
Baseline Documentation Method:	Trending of heating and cooling valves shows both open during outdoor temperatures from 45F-60F		
Measure:	Provide heating/cooling mode programming which does not allow both valves to be open at once. Estimated savings of 1,155 kBtu of Chilled Water and 27,716 kBtu of Hot Water. Estimated Contractor Cost of $1,276 and PBEEEP Provider Cost of $594.		
Recommendation for Implementation:	Provide controls programming to allow only one valve to be open at a time. Based on DAT setpoint the AHU should be in either a heating or cooling mode and modulating only the appropriate valve to maintain the DAT setpoint.		
Evidence of Implementation Method:	Trending of AHU-4 heating and cooling valve positions, OAT, and DAT. The trending must occur during outside air temps of 45F-60F. The trending interval to be 15 minutes or less and be recording for a minimum of 3 weeks.		

Estimated Annual Total Savings ($):	$0	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.00	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.00	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.0%	Percent of Implementation Costs:	0.0%

Deleted Findings Details

Building: Elmer Anderson Office Building

FWB Number:	11801	Eco Number:	6
Site:	Elmer Anderson	Date/Time Created:	5/30/2012

Investigation Finding:	Heating valves operating during unoccupied hours: payback > 15 yrs	Date Identified:	2/1/2012
Description of Finding:	Trending of the AHU heating valves shows that AHUs 1, 2, 5, 7, and 10 heating valves are fully open during unoccupied hours and the units are off. Valves are likely open as a freeze protection strategy. The AHUs already have freeze-stats and MAT sensors. These should open the valve when temperatures inside the unit are too low. At this point the valves simply open fully when the unit turns off. Sebesta calculated pump and heating savings for this measure. It is likely that the pump savings will occur, but heating savings will not because although heat is lost through the HW pipe system, it will go into the conditioned space. When CEE removed the heating savings from this measure, the payback went well above 15 years and so this measure was deleted by PBEEEP.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Deleted
Finding Type:	Finding Deleted by PBEEEP		

Implementer:	Controls Contractor	Benefits:	Reduced pump run-hours and electricity usage. Reduced HHW usage due to standby loss in piping and heating coils.
Baseline Documentation Method:	Trending of AHU heating valves and HHW pump operation.		
Measure:	Utilize MAT and freeze-stat sensors for unoccupied freeze protection. Estimated savings of 2,943 kWh and 198,954 kBtu of Hot Water. Estimated Contractor Cost of $10,912 and PBEEEP Provider Cost of $1,188.		
Recommendation for Implementation:	Reprogram heating valves to be closed during unoccupied times. Provide programming for when a freeze-stat trips the heating valves will be commanded fully open. Add mixed air temperature sensor to hot deck mixed air sections. Also provide a low mixed air temperature, for all mixed air sections (40F adj.) alarm which when tripped the heating valve is commanded fully open. Commission both freeze-stats, and the new low mixed air temperature alarm sequence.		
Evidence of Implementation Method:	Trending of OAT, MAT, freeze-stat alarms and heating valve position. Trending interval to be 15 minutes or less for a minimum duration of 3 weeks. Functionally test freeze protection safeties and provide written/signed documentation proving the described safeties are in place and operational.		

Estimated Annual Total Savings ($):	$0	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.00	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.00	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.0%	Percent of Implementation Costs:	0.0%

PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

SCREENING RESULTS FOR
ELMER L. ANDERSEN HUMAN SERVICES BUILDING

June 9, 2010

Minnesota Department of Human Services

Summary Table

Facility Name	Elmer L. Andersen Human Services Building
Location	540 Cedar Street, St. Paul, MN 55101
Facility Manager	Gene Peterman
Number of Buildings	1
Interior Square Footage	395,752
Parking Ramp Square Footage	231,599
PBEEEP Provider	CEE (Angela Vreeland)
State's Project Manager	Chris Guevin
RECS Project Number	02657ASD
Date Visited	June 4, 2010
Annual Energy Cost	$1,058,293 (2009)
Utility Company	Xcel Energy (Electric and Natural Gas), District Energy St. Paul (Hot and Chilled Water)
Site Energy Use Index (EUI)	127.5 kBtu/ft^2 (2009)
Benchmark EUI (from B3)	114.5 KBtu/ft^2

Recommendation for Investigation

A full investigation of the Elmer L. Andersen Human Services Building and attached parking ramp is recommended.

Building Name	State ID	Square Footage	Year Built
Andersen Human Services Building	G02310273	395,752	2005
Andersen Parking Ramp		231,599	2005

Elmer L. Andersen Human Services Building Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. The screening of the Elmer L. Andersen Human Services Building (Andersen Office Building) was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. This report is the result of that information.

The Andersen Office Building is one large detached building consisting of 395,752 interior square feet. The building has nine stories above ground and one below. The conditioned spaces are primarily offices and there is a data center on the basement level. Levels 5 and 6 and Levels 7 and 8 have open staircases between them while the rest of the floors are closed off to one another. The building has an attached seven story unconditioned parking ramp. The building was constructed in 2005 and was commissioned at the time of construction.

The building runs on a Honeywell EBI R310.1 automation system, which is part of the State Capitol Complex system. All equipment is DDC and all equipment is on the automation system except several Cabinet Unit Heaters, Unit Heaters, and pumps.

The building uses chilled and hot water from District Energy St. Paul. Some of the District chilled water is routed directly to the air handling units (AHUs) and some is run through heat exchangers that send chilled water to Computer Room Air Conditioning (CRAC) units in the data center. The District hot water is run through heat exchangers and the hot water is sent to the air handlers and terminal equipment. There are two natural gas steam boilers that are used solely for humidification in the air handlers.

There are a total of ten AHUs serving the Andersen Office Building. Nine of the AHUs are located in the Penthouse (Level 9) and are variable air volume units with VAV boxes and/or Fan-Powered VAV (FPVAV) boxes. There is one constant volume air handler located on the first floor (Level 1) that serves the loading dock area. Levels 0 (the below ground level) and 1 have VAV boxes in the ceiling plenums. Levels 2-8 have underfloor supply plenums with perimeter FPVAVs. There are round floor diffusers that can be adjusted to supply varying amounts of air to the spaces directly from the underfloor supply plenum. There are also FPVAVs on these floors that are ducted to diffusers along the exterior walls. The FPVAVs take air from the underfloor supply plenum and heat it as needed based on thermostats along the exterior walls. The occupants have no control over the space temperature except for adjusting the amount of air coming out of the round floor diffusers. Level 9 is the Penthouse and is heated by eleven fan coil units.

The attached parking ramp is unconditioned with the exception of the stairwells and elevator lobbies, which are heated by small unit heaters and fan coil units. The first and second floors of the ramp have large ducted exhaust fans that control to CO and CO_2. The remaining floors of the ramp (Levels 3-7) are more open to the outside and do not have exhaust fans.

The facility just recently had a lighting study performed which includes energy saving recommendations; this study will be a source of measures to be considered for implementation under PBEEEP.

There is one natural gas meter, one electric meter, two District Energy (St. Paul) meters (one for chilled water and one for hot water), and one fuel oil meter. Fuel oil is used only by the back-up generator.

A full energy investigation of the Andersen Office Building is recommended. Although the building is only five years old and was commissioned, the building has a higher than expected Energy Use Intensity (EUI). The EUI of the building is 11% higher than the B3 benchmark, which indicates that there are opportunities for reducing energy use, although it was designed under a code intended to produce a building that used 30% less energy than this benchmark. In addition, the building is fully automated, which increases the likelihood that energy reduction measures can be implemented cost-effectively.

This screening report is based on the PBEEEP Guidelines. It is based on one site visit, review of the facility documentation, building automation system, a limited inspection of the facility and interviews with the staff. The purpose of the screening report is to evaluate the potential of the facility for the implementation of cost-effective energy efficiency savings through recommissioning. To the best of our knowledge the information here is accurate. It provides a high level view of many, but by no means all, of the important parameters of the mechanical equipment in the facility. Because it is the result of a limited audit survey of the facility, it may not be completely accurate.

Andersen Office Building				**State ID# G02310273**	
Area (sqft)	395,752	Year Built	2005	Occupancy (hrs/yr)	3,510
HVAC Equipment					

- **10 AHUs**

NAME	**SIZE**	**TYPE**	**NOTES**
AHU 1	40,000 CFM 75 hp SF, 20 hp RF	VAV	VFDs on SF and RF, Single-zone with Hot and Cold Deck, Serves VAV boxes on Levels 6 and 7
AHU 2	40,000 CFM 75 hp SF, 20 hp RF	VAV	VFDs on SF and RF, Single-zone with Hot and Cold Deck, Serves VAV boxes on Level 8
AHU 3	34,000 CFM 75 hp SF, 20 hp RF	VAV	VFDs on SF and RF, Single-zone, Serves VAV boxes on Levels 0-8
AHU 4	34,000 CFM 75 hp SF, 15 hp RF	VAV	VFDs on SF and RF, Single-zone, Serves VAV boxes on Level 1
AHU 5	44,000 CFM 100 hp SF, 20 hp RF	VAV	VFDs on SF and RF, Single-zone with Hot and Cold Deck, Serves VAV boxes on Levels 2 and 3
AHU 6	40,000 CFM 75 hp SF, 20 hp RF	VAV	VFDs on SF and RF, Single-zone with Hot and Cold Deck, Serves VAV boxes on Levels 4 and 5
AHU 7	40,000 CFM 75 hp SF, 20 hp RF	VAV	VFDs on SF and RF, Single-zone with Hot and Cold Deck, Serves VAV boxes on Levels 6 and 7
AHU 8	40,000 CFM 75 hp SF, 20 hp RF	VAV	VFDs on SF and RF, Single-zone with Hot and Cold Deck, Serves VAV boxes on Levels 4 and 5
AHU 9	44,000 CFM 100 hp SF, 20 hp RF	VAV	VFDs on SF and RF, Single-zone with Hot and Cold Deck, Serves VAV boxes on Levels 2 and 3
AHU 10	4,000 CFM 5 hp SF	Constant Volume	Single-zone, Face/Bypass, Serves the loading dock area on Level 1

HVAC Equipment- Continued

- **112 Variable Air Volume (VAV) Boxes:** Ratings between 110 and 2,630 CFM, most have HW reheat
- **294 Fan Powered VAV Boxes (FPVAV):** Ratings of 520 or 575 CFM, most have HW reheat
- **13 Fan Coil Units (FCU):** Ratings between 1,600 and 5,000 cfm
- **12 Computer Room Air Conditioning (CRAC) Units:** Ratings between 13.5 and 20 Tons
- **2 Steam Boilers:** Used for humidification in AHUs, low-pressure steam, natural gas, 1,176 kBtu/hr output each.
- **24 Pumps**
    - 5 CHW Pumps: All variable volume with VFDs, 3 for the Data Center (7.5hp each), 2 for the AHUs (50hp each)
    - 2 HW Pumps: Both variable volume with VFDs, 25hp each
    - 3 Boiler Feed Pumps: All constant volume, 1/3hp each
    - 2 Circulating Pumps: Both constant volume, 1/6hp each
    - 3 Condensate Pumps: All constant volume, (1) 1/3hp, (2) 1/5hp
    - 3 Domestic Booster Pumps: All constant volume, (1) 1.5hp, (2) 7.5hp
    - 2 Fuel Oil Pumps: Both constant volume, 1/4hp each
    - 4 Sump Pumps: All constant volume, (2) 1/2hp, (2) 3/4 hp
- **7 Cabinet Unit Heaters:** Ratings between 800 and 1,500 CFM
- **18 Unit Heaters**: Ratings between 380 and 2,700 CFM
- **8 Heat Exchangers:** 4 for CHW to the Data Center, 3 for HW, 1 for Boiler Feed Water
- **7 Exhaust Fans**: Ratings between 750 to 12,380 CFM
- **3 Stairwell Pressurization Fans:** 8,000 CFM each
- **15 Supply Fans:** Used during generator operation, 9,000 cfm each
- **2 Air Compressors:** Used during generator operation, 7.5hp each
- **1 Back-up Generator:** 1,250 kW output

Points on BAS
• **AHUs 1-2, 5-9 Points**: RAT, RA CO2, RA CO2 setpoint, RF status, RF CFM, EA damper, Hot deck damper, Cold deck damper, OA damper, MAT before cooling coil, Heat valve, Cool valve, DA RH, SF status, SF CFM, DA DSP, DA RH, DAT, Occupancy, Max space temp, DAT setpoint, Econ mode limits • **AHU 3-4 Points**: Return damper, RA RH, RA CO2, RA CO2 setpoint, RAT, RF status, RF CFM, MA damper, MAT, MAT setpoint, Heat valve, Cool valve, DA RH, SF status, SF CFM, DA DSP, DAT, Supply damper, Occupancy, Max space temp, DAT reset parameters • **AHU 10 Points**: RAT, MA damper, MAT, Face Bypass damper, Heat valve, Cool valve, SF status, DAT, DA DSP, Occupancy, Room temp • **VAV Points**: Summer mode setpoint, Winter mode setpoint, Setpoint offset, Summer Winter Mode, Setpoint, Room temp, Reheat CFM, CFM setpoint, Max CFM, Min CFM, HW valve • **FPVAV Points**: Room temp, Room setpoint, Reheat valve, Fan speed, Fan status (cool/heat) • **FCU Points**: Room temp, Room setpoint, Reheat valve, Cooling valve, Fan status • **CRAC Unit Points**: Room temp, Room RH • **Boiler Points**: Boiler system enable, Lead boiler, Steam pressure, Valve to make-up water exchanger, Steam temp • **CHW System Points**: Pump status, Pump speed, AHU CHWST, AHU CHWRT, AHU CHW DP, Data center CHWST, Data Center CHWRT, Data center CHW DP, Data center CHWS GPM, Data center supply/return temp difference • **EF Points**: EF status, EA DSP (EFs 3 and 4 only) • **Stairwell Pressurization Fan Points**: Fan status, Damper position, Stairwell DP, Stairwell DP setpoint
Capabilities of BAS
• The BAS is fully capable of trending. The Plant Management Division (PMD) of the Department of Administration controls the BAS. • There are 24,000 points available for trending. • PMD will set up all trending required for the project based on the direction of the provider. • The trend data will be exported in a standard format such as csv.

Andersen Parking Ramp					
Area (sqft)	231,599	Year Built	2005	Occupancy (hrs/yr)	N/A
HVAC Equipment					
• **2 Exhaust Fans:** Both rated at 16,000 CFM • **7 Fan Coil Units (FCU):** All rated at 300 CFM • **4 Unit Heaters**: All rated at 380 CFM					
Points on BAS					
• **FCU Points**: Room temp, Room setpoint, Reheat valve, Cooling valve, Fan status • **EF Points**: EF status					
Capabilities of BAS					
• See Andersen Office Building for details					

Additional comments by building staff

- The VAV boxes operate at a reduced airflow during unoccupied hours.
- There is a lighting control system, but little information is known about it.
- All HVAC equipment is original to the building when it was built in 2005.
- The most common occupant complaint is that it is too cold in the spaces, even during the summer.

PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	HP	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWRT	Hot Water Return Temperature
CDWST	Condenser Water Supply Temperature	HWST	Hot Water Supply Temperature
CFM	Cubic Feet per Minute	kW	Kilowatt
CHW	Chilled Water	kWh	Kilowatt-hour
CHWRT	Chilled Water Return Temperature	MA	Mixed Air
CHWDP	Chilled Water Differential Pressure	MA Enth	Mixed Air Enthalpy
CHWST	Chilled Water Supply Temperature	MARH	Mixed Air Relative Humidity
CRAC	Computer Room Air Conditioner	MAT	Mixed Air Temperature
CV	Constant Volume	MAU	Make-up Air Unit
DA	Discharge Air	OA	Outside Air
DA Enth	Discharge Air Enthalpy	OA Enth	Outside Air Enthalpy
DARH	Discharge Air Relative Humidity	OARH	Outside Air Relative Humidity
DAT	Discharge Air Temperature	OAT	Outside Air Temperature
DDC	Direct Digital Control	Occ	Occupied
DP	Differential Pressure	PTAC	Packaged Terminal Air Conditioner
DSP	Duct Static Pressure	RA	Return Air
DX	Direct Expansion	RA Enth	Return Air Enthalpy
EA	Exhaust Air	RARH	Return Air Relative Humidity
EAT	Exhaust Air Temperature	RAT	Return Air Temperature
Econ	Economizer	RF	Return Fan
EF	Exhaust Fan	RH	Relative Humidity
Enth	Enthalpy	RTU	Rooftop Unit
ERU	Energy Recovery Unit	SF	Supply Fan
FCU	Fan Coil Unit	Unocc	Unoccupied
FPVAV	Fan Powered VAV	VAV	Variable Air Volume
FTR	Fin Tube Radiation	VFD	Variable Frequency Drive
GPM	Gallons per Minute	VIGV	Variable Inlet Guide Vanes
HD	Hot Deck		

Conversions:
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH